

Senior High School

Physical Science

Quarter 1 – Module 7:

Biological Macromolecules



Physical Science
Alternative Delivery Mode
Quarter 1 – Module 7: Biological Macromolecules
First Edition 2020

Republic Act 8293, Section 176 states that “no copyright shall subsist in any work of the Government of the Philippines. However, prior approval of the government agency or office wherein the work is created shall be necessary for exploitation of such work for profit. Such agency or office may, among other things, impose as a condition the payment of royalties.”

Borrowed materials (i.e., songs, stories, poems, pictures, photos, brand names, trademarks, etc.) included in this module are owned by their respective copyright holders. Every effort has been exerted to locate and seek permission to use these materials from their respective copyright owners. The publisher and authors do not represent nor claim ownership over them.

Published by the Department of Education Angelica J. Macaraeg
Secretary: Leonor Magtolis Briones
Undersecretary: Diosdado M. San Antonio

Development Team of the Module

Writers: Amy B. Villar, Jennifer O. Tullao

Editors: Robert G. Yumul

Felipa A. Morada

Reviewers: Ramonito O. Elumbaring, Angelica J. Macaraeg

Felipa A. Morada

Illustrator: Francis Victor A. Medrano

Layout Artist: Mary Grace L. Asa

Pamela A. Lalusin

Management Team: Wilfredo E. Cabral

Job S. Zape Jr.

Eugenio S. Adrao

Elaine T. Balaogan

Susan DL. Oribiana

Lorna R. Medrano

Edita T. Olan

Printed in the Philippines by _____

Department of Education – Region IV-A CALABARZON

Office Address: Gate 2 Karangalan Village, Barangay San Isidro
Cainta, Rizal 1800
Telefax: 02-8682-5773/8684-4914/8647-7487
E-mail Address: region4a@deped.gov.ph

Senior High School

Physical Science

Quarter 1 – Module 7:

Biological Macromolecules

Introductory Message

For the facilitator:

Welcome to the Physical Science 11 Alternative Delivery Mode (ADM) Module on Biological Macromolecules.

This module was collaboratively designed, developed and reviewed by educators both from public and private institutions to assist you, the teacher or facilitator in helping the learners meet the standards set by the K to 12 Curriculum while overcoming their personal, social, and economic constraints in schooling.

This learning resource hopes to engage the learners into guided and independent learning activities at their own pace and time. Furthermore, this also aims to help learners acquire the needed 21st century skills while taking into consideration their needs and circumstances.

In addition to the material in the main text, you will also see this box in the body of the module:



Notes to the Teacher

This contains helpful tips or strategies that will help you in guiding the learners.

As a facilitator you are expected to orient the learners on how to use this module. You also need to keep track of the learners' progress while allowing them to manage their own learning. Furthermore, you are expected to encourage and assist the learners as they do the tasks included in the module.

For the learner:

Welcome to the Physical Science 11 Alternative Delivery Mode (ADM) Module on Biological Macromolecules!

The hand is one of the most symbolized part of the human body. It is often used to depict skill, action and purpose. Through our hands we may learn, create and accomplish. Hence, the hand in this learning resource signifies that you as a learner is capable and empowered to successfully achieve the relevant competencies and skills at your own pace and time. Your academic success lies in your own hands!

This module was designed to provide you with fun and meaningful opportunities for guided and independent learning at your own pace and time. You will be enabled to process the contents of the learning resource while being an active learner.

This module has the following parts and corresponding icons:



What I Need to Know

This will give you an idea of the skills or competencies you are expected to learn in the module.



What I Know

This part includes an activity that aims to check what you already know about the lesson to take. If you get all the answers correct (100%), you may decide to skip this module.



What's In

This is a brief drill or review to help you link the current lesson with the previous one.



What's New

In this portion, the new lesson will be introduced to you in various ways such as a story, a song, a poem, a problem opener, an activity or a situation.



What is It

This section provides a brief discussion of the lesson. This aims to help you discover and understand new concepts and skills.



What's More

This comprises activities for independent practice to solidify your understanding and skills of the topic. You may check the answers to the exercises using the Answer Key at the end of the module.



What I Have Learned

This includes questions or blank sentence/paragraph to be filled into process what you learned from the lesson.



What I Can Do

This section provides an activity which will help you transfer your new knowledge or



Assessment

skill into real-life situations or concerns.

This is a task which aims to evaluate your level of mastery in achieving the learning competency.



Additional Activities

In this portion, another activity will be given to you to enrich your knowledge or skill of the lesson learned. This also tends retention of learned concepts.



Answer Key

This contains answers to all activities in the module.

At the end of this module you will also find:

References

This is a list of all sources used in developing this module.

The following are some reminders in using this module:

1. Use the module with care. Do not put unnecessary mark/s on any part of the module. Use a separate sheet of paper in answering the exercises.
2. Don't forget to answer *What I Know* before moving on to the other activities included in the module.
3. Read the instruction carefully before doing each task.
4. Observe honesty and integrity in doing the tasks and checking your answers.
5. Finish the task at hand before proceeding to the next.
6. Return this module to your teacher/facilitator once you are through with it.

If you encounter any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator. Always bear in mind that you are not alone.

We hope that through this material, you will experience meaningful learning and gain deep understanding of the relevant competencies. You can do it!

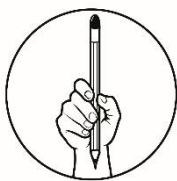


What I Need to Know

This module was designed and written with you in mind. It is here to help you explain how the structures of biological macromolecules such as carbohydrates, lipids, nucleic acid, and proteins determine their properties and functions. The scope of this module permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary level of students. The lessons are arranged to follow the standard sequence of the course. But the order in which you read them can be changed to correspond with the textbook you are now using.

After going through this module, you are expected to:

1. distinguish between carbohydrates, proteins, lipids, and nucleic acids;
2. summarize the general characteristics of each biomolecule; and
3. relate the structures of the biomolecules with their properties.



What I Know

Modified TRUE or FALSE. On the space before each number, write **TRUE** if the statement is correct; if the statement is **FALSE**, change the italicized word to make it true.

- _____ 1. *Carbohydrates* contain carbon.
- _____ 2. Meat is an example of *protein*.
- _____ 3. Lipids are *soluble* in water.
- _____ 4. *Proteins* are made up of nucleotides.
- _____ 5. *DNA* is a nucleic acid.
- _____ 6. Sucrose is a *disaccharide*.
- _____ 7. *Starch* is composed of many glucose units.
- _____ 8. *Fructose* is also known as blood sugar.
- _____ 9. Keratin is *easily* dissolved in water.
- _____ 10. Proteins are made up of *nucleotides*.
- _____ 11. The iron group of *hemoglobin* is called a heme group.
- _____ 12. A nucleotide has *three* parts: nitrogenous base, sugar, and phosphate group.
- _____ 13. DNA has a *double-helix* structure.
- _____ 14. Triglyceride is a *protein*.
- _____ 15. Generally, *unsaturated* fatty acids remain solid at room temperature.

Lesson

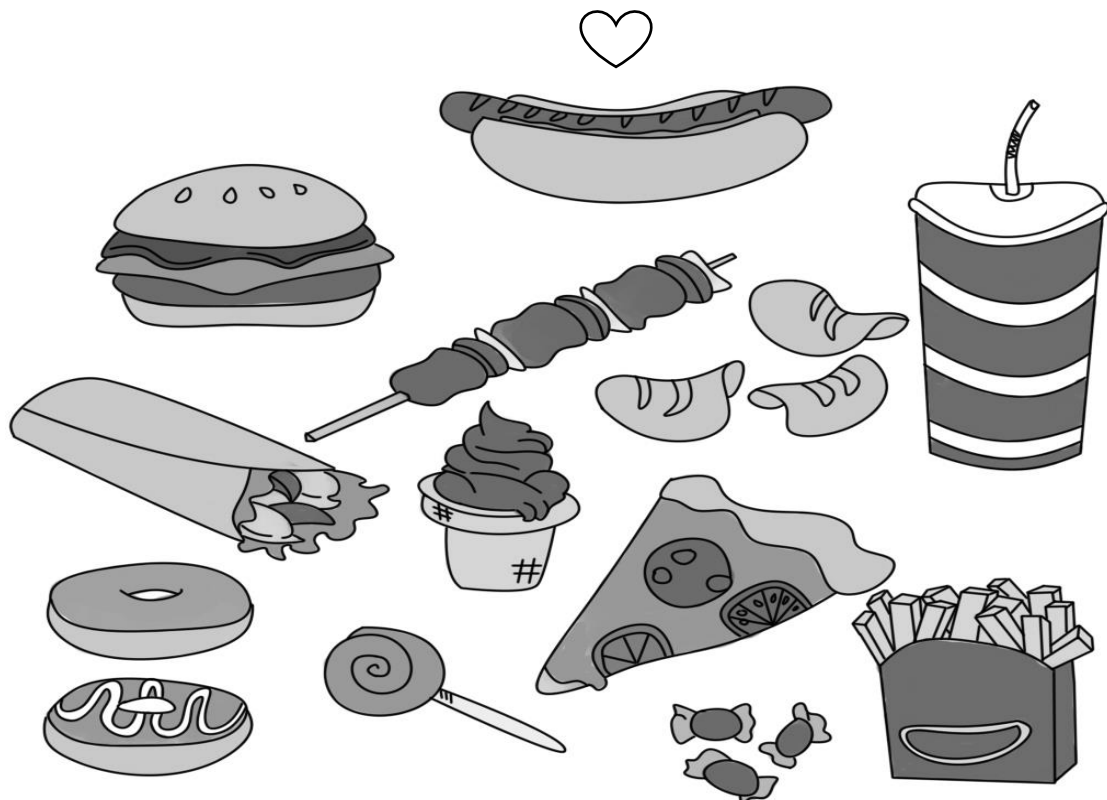
1

Biological Macromolecules

Biological macromolecules are large, organic molecule such as carbohydrates, lipids, proteins, and nucleic acids. Most of them are organic compounds and the functional group determines their chemical properties. Biomolecules have a huge variety of functions, such as storing energy, protection, etc. Now be ready with your journey to the different biomolecules, their structures, and functions found in your food.



Hello! I am your nutritionist for today. Go ahead and think for a moment about your favorite food.



Analyze the Nutritional Facts of a food product given below and rank the nutrients needed by the following patients based on importance.

- A. a patient with hypertension
- B. a patient renal failure
- C. a patient with diabetes mellitus

Nutrition Facts

Serving Size 32 g

Serving Per Pack 1

Amount/Serving	%RNI
Total Calories 150 Calories from Fat 45	6%
Total Fat 5g Saturated Fat 3g + <i>Trans Fat 0g</i>	
Cholesterol 3mg	
Sodium 170mg	35%
Total Carbohydrates 23g Dietary Fiber 0g Sugars 4g	0%
Protein 3g	4%
Calcium 55mg	8%
Iron 1mg	8%



What's In

Food is a source of molecules that are needed for life. These are biological molecules. What you eat belongs to **biomolecules**. There are four biological molecules that make up all of life. Now, I have here a word hunt for your warm up.

Look for the words and write your answer: biomolecule, carbohydrate, lipid, protein, and nucleic acid.

F	A	T	S	H	Y	L	I	P	I	D	P
U	P	I	A	T	E	P	R	O	T	E	R

N	U	C	L	E	I	C	A	C	I	D	O
Y	T	K	T	L	P	D	G	O	G	O	T
C	A	R	B	O	H	Y	D	R	A	T	E
A	R	O	A	A	H	L	E	W	V	W	I
B	I	O	M	O	L	E	C	U	L	E	N

You are really doing great! It seems that you are now ready for our first biomolecule.



Notes to the Teacher

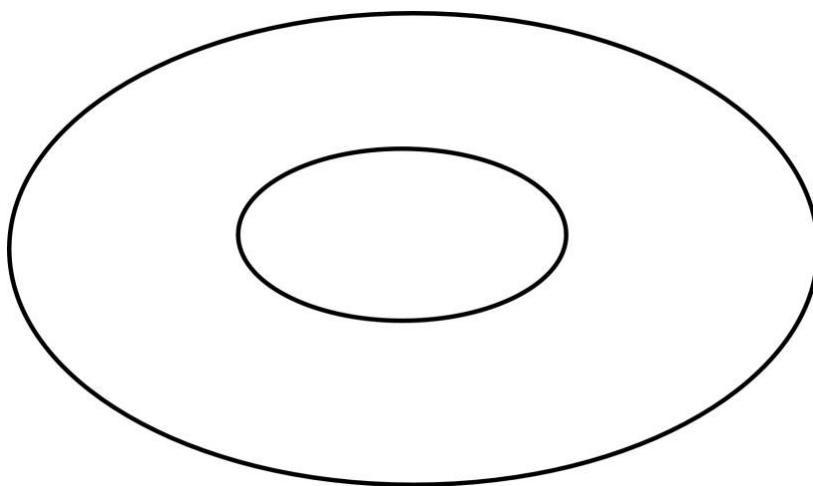
Ask learners to list examples of carbohydrate, lipid, protein, and nucleic acid. Add on the list sources that are not mentioned by the learners.



What's New

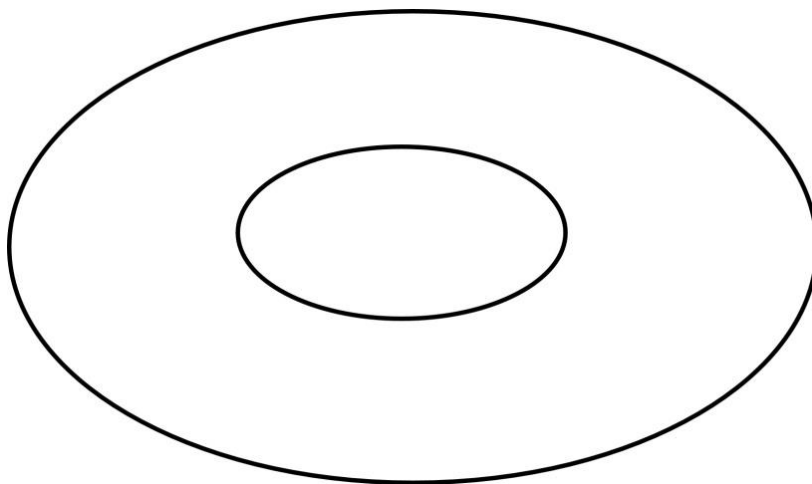
Activity 1.1 Macromolecule Plates and Glass

1. Write inside the first plate an example of food rich in carbohydrates that you have eaten a while ago and tell us what you feel after eating it.



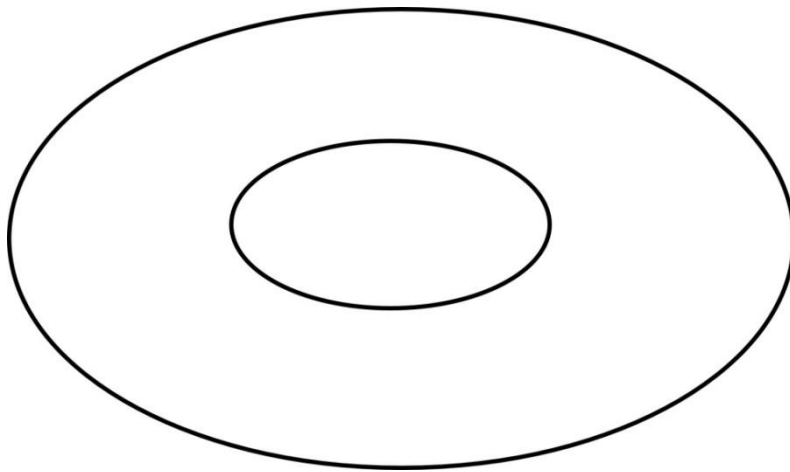
What did you feel after eating the food rich in carbohydrates?

2. Write inside the second plate an example of food rich in lipids that you have eaten a while ago.



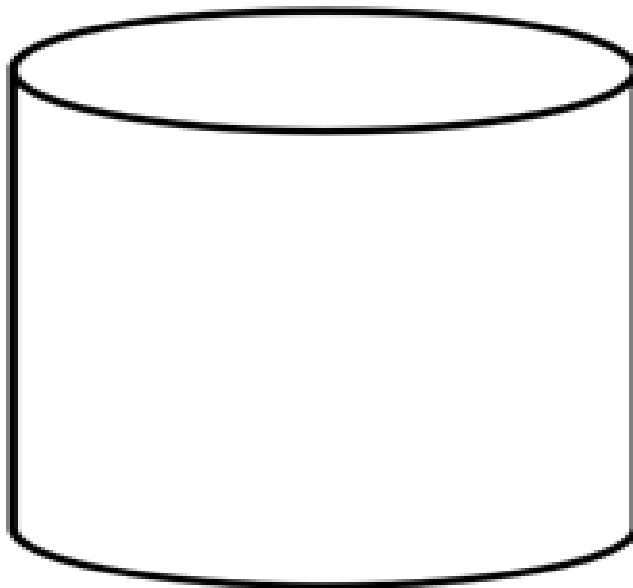
What did you feel after eating the food rich in lipids?

3. Write inside the third plate an example of food rich in protein that you have eaten a while ago and tell us what you feel about what you have eaten.



What did you feel after eating the protein - rich food?

4. Write inside the glass the function of nucleic acids.





What is It

Terms and Definitions

Monosaccharide – simplest form of carbohydrates

Monomer – a molecule that can react with other molecule to form very large molecules or polymers

Peptide – short chain of amino acid monomer link by peptide bonds

Hormones – special chemical messengers that are created in the endocrine gland

Amino acids – organic compounds that combined to form proteins

Enzymes – proteins which make the bio chemical reaction fast

Nucleotide – made up of three components: nitrogen-containing base, five-carbon sugar, and a phosphate group

Phospholipids - contain glycerol, two-fatty acids, and a phosphate group

Biological Macromolecules

1. Carbohydrates

The word **carbohydrate** may be broken down to carbon and hydrate. Another term for carbohydrate is **saccharide**. Carbohydrates are classified either as simple or complex. Simple sugars are **monosaccharide** and **disaccharides**. Complex sugars are **polysaccharides**.

Carbohydrates are the primary energy source of the human body. The different saccharides that humans eat are converted to glucose which can be readily used by the body. The excessive consumption of carbohydrates is converted to glycogen which is stored in the liver and in muscles. **Glycogen** is a slow-releasing carbohydrate

Monosaccharide (one saccharide)

Glucose	used in dextrose, blood sugar; the form utilized by the human body
Galactose	found in milk and milk products
Fructose	found in fruits and honey

Disaccharides (two saccharides)

Maltose	glucose + glucose	found in malt
Sucrose	glucose + fructose	found in regular table sugar, sugarcane, and sugar beet
Lactose	glucose + galactose	found in milk and milk products

Polysaccharides (many saccharides)

Starch / Amylose	storage form of glucose in plants
Amylopectin	storage form of glucose in plants
Glycogen	storage form of glucose animal; stored in the liver and muscles
Cellulose	structural material in plants--cell wall in wood, wood fiber cannot be digested by humans

Carbohydrates

They are made from carbon, hydrogen, and oxygen.

Monomer: saccharides

Examples: rice, cereal, potatoes, fruits, pastas

Function: main energy source of the body

Did you know that?

Marathon runners, tri-athletes, and other runners eat carbohydrates for weeks leading up to a big event. They call it “carbo-loading”. What’s the point?

As the athletes consume massive amounts of starch and pasta, the energy begins to store up in their body, saving itself for use during the event.

2. Lipids or Fats

Lipids or fats are important nutrients in your body but eating too many especially unhealthy fats such as **saturated fats** and **trans fats** can lead to heart disease, cancer, and obesity. Lipids also serve other functions such as material for cell membrane, insulation to maintain body temperature, aid in digestion, and as signal molecules.

There are different classifications of lipids: **triglyceride**, **phospholipid**, **wax**, and **steroid**. The lipid family is one of the most varied in terms of structure but they share the common property of being insoluble in water.

Fat and **oil** are the most common examples of lipids. They are under triglycerides because they are composed of glycerol and three fatty acids.

Fat refers to solid triglyceride usually from animal sources such as meat, milk, butter, margarine, eggs, and cheese. **Oil** refers to liquid triglycerides from plant sources. Examples are olive oil, corn oil, sunflower oil, and soybean oil. Animal fats contain high percentages of saturated fatty acids while plant oils are mostly unsaturated fatty acids.

Lipids

They are made from carbon, hydrogen, and oxygen

They are soluble (dissolve) in oil but are insoluble (don’t dissolve) in water.

Examples: fats and oils

Function: long-term storage of energy in the body

Monomer: fatty acid

3. Proteins

Proteins are composed of four elements, namely: **carbon**, **hydrogen**, **oxygen**, and **nitrogen**. Sulfur and other metals are sometimes also found in proteins. If carbohydrates are made up of saccharides, proteins are made up of **amino acids**.

Examples of proteins and their functions are:

1. **Keratin** is a structural protein found in hair, skin, and nails.
2. **Fibroin / Silk protein** - Fibroin is found in silk. Silk has a smooth and soft texture. It is one of the strongest natural fibers that have high resistance to deformation. It is also a good insulating material.
3. **Collagen** is a major insoluble fibrous protein found in connective tissues such as tendons, ligaments, skin, cartilage and the cornea of the eye. It comprises as much as 30% of proteins in animals.
4. **Enzymes** function to catalyze chemical reactions. They either speed up a reaction, lower the needed energy for a reaction to take place, or bind substances to their specific partners.

Examples of enzymes

- a. **Lipase** - help in digestion of fats
 - b. **Pepsin** - help in breaking down proteins into peptides (smaller units)
 - c. **Sucrase** - also called invertase; help in the digestion of sugars and starches
5. **Myoglobin** is a polypeptide that stores oxygen in muscles. It contains a heme group which has an iron where the oxygen is stored.

Proteins

They are made from carbon, hydrogen, oxygen, and nitrogen

Proteins are made up of amino acids combined through a dehydration link called a peptide bond.

Monomer: amino acid

Two classes:

1. **Saturated fats** have two carbons attached to each carbon (except the one at the end). Saturated fats are unhealthy fats like butter.
2. **Unsaturated fats** are missing at least one hydrogen and are curl in shape. The unsaturated fats are healthy, and include oils.

4. Nucleic Acids

Nucleic acids play an essential role in the storage, transfer, and expression of genetic information. Nucleic acid was discovered by a 24-year old Swiss physician named Friedrich Miescher in 1868. He was puzzled that an unknown substance in white blood cells did not resemble carbohydrates, proteins, or lipids. He was able to isolate the substance from the nucleus and initially called it **nuclein**. He eventually was able to break down nuclein into protein and nucleic acids. He found out that nucleic acids contain carbon, hydrogen, oxygen, nitrogen, and phosphorus.

The most common examples of nucleic acids are **DNA** (deoxyribonucleic acid) and **RNA** (ribonucleic acid). **DNA** is a nucleic acid that carries the genetic code of organisms. It is fondly termed as the blueprint of life. **RNA**, on another hand, carries the information from the DNA to the cellular factories for the synthesis of proteins. If carbohydrates are composed of saccharide units, proteins of amino acids, and lipids of fatty acids, nucleic acids are composed of **nucleotides**. Nucleic acids are also known as **polynucleotides**.

Three parts of nucleotide:

1. Nitrogenous base
2. Five-carbon carbohydrate or sugar
3. Phosphate group

Nucleic Acids

They are made from carbon, hydrogen, oxygen, nitrogen, and phosphorus.

Monomer: nucleotide

Examples: DNA and RNA

Function: involves the genetic materials, Deoxyribonucleic Acid (**DNA**) and Ribonucleic Acid (**RNA**). DNA is the blueprint of life because it contains instructions on how to make proteins in the body.

Structures of the Different Biomolecules

Remember this mnemonic device of biomolecules: CHO CHO CHON CHONP

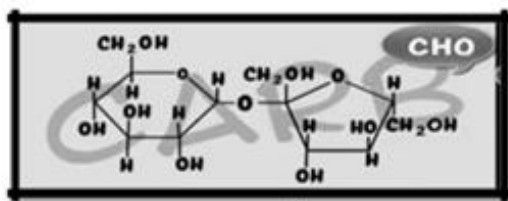
C stands for the element **Carbon**

H stands for the element **Hydrogen**

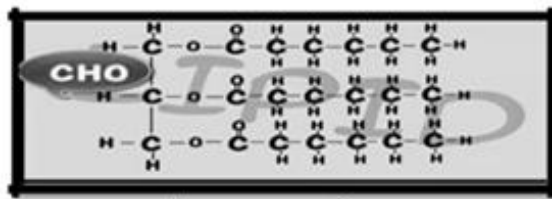
O stands for the element **Oxygen**

N stands for the element **Nitrogen**

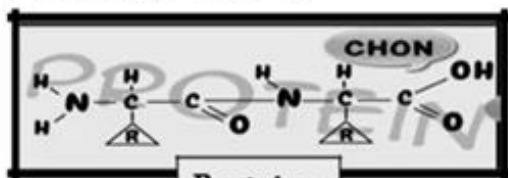
P stands for the element **Phosphorus**



Carbohydrates



Lipids



Proteins

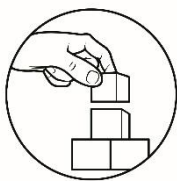


Nucleic Acids



Again, say the mnemonic device.

CHO CHO CHON CHONP!



What's More

Activity 1.2 Meal Plan

Think of a 3 – day healthy meal plan for a teenager like you following the table below. Make sure that you choose the right kind of food containing carbohydrates, proteins, and lipids.

3 – Day Meal Plan

	Day 1	Day 2	Day 3
Breakfast			
Morning Snack			
Lunch			
Afternoon Snack			
Dinner			
Dessert			



What I Have Learned

Activity 1.3 Maze Runner

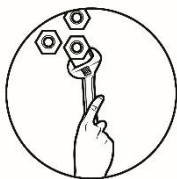


I have a friend named Bimol. He needs our help in finding the right way to go back to his house. In order to help him, you need to answer some questions about biomolecules.



Hello! My name is Bimol. I have a problem. I cannot go back home. Please help me by answering the questions.

<div>1</div> <div>Carbohydrates</div> <p>What elements are they composed of?</p> <p>_____</p> <p>What is the monomer?</p> <p>_____</p> <p>What is its function for the body?</p> <p>_____</p> <p>Write two examples: _____</p>	<div>Lipids</div> <p>What elements are they composed of?</p> <p>_____</p> <p>What is the monomer?</p> <p>_____</p> <p>What is its function for the body?</p> <p>_____</p> <p>Write two examples: _____</p>
<div>2</div> <div>Proteins</div> <p>What elements are they composed of?</p> <p>_____</p> <p>What is the monomer?</p> <p>_____</p> <p>What is its function for the body?</p> <p>_____</p> <p>Write two examples: _____</p>	<div>3</div> <div>Nucleic Acids</div> <p>What elements are they composed of?</p> <p>_____</p> <p>What is the monomer?</p> <p>_____</p> <p>What is its function for the body?</p> <p>_____</p> <p>Write two examples: _____</p>
<div>4</div> <p>Thanks for helping Bimol!</p> <div>HOME</div>	



What I Can Do

Activity 1.4

Carbohydrates	rice oil pork apple sugar nitrogen
Lipids	wax fish fatty acid mango lemon
Proteins	beef potato amino acid avocado
Nucleic Acids	bread chicken carbon oxygen phosphorous

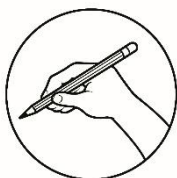
Complete the table filling out the required information. Identify the disorder/disease, related macromolecule and its function based on the given scenario.

1. Covida, a grade 12 student experienced excessive sweating, frequent urination, feeling very thirsty and hungry. She was not able to attend her class during that day. She was rushed in the hospital and upon examining her blood sugar it was found out that it is above its normal value.

2. One of the students of Mr. Corona shared her story when she was hospitalized at the age of three. She showed her picture with enlarged tummy, loss of muscle mass and inflamed patches on her skin. She even mentioned that she was also irritable and had failure to grow in height according to her mother.

3. While presenting the lesson on Circulation and Gas Exchange, the teacher of Pandemic Integrated National High School complains shortness of breath, tightness and aching sensation in his chest that radiates to his neck and jaw.

Disorders/ Diseases	Related Macromolecules	Function of Macromolecules



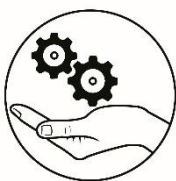
Assessment

Multiple Choice. Read and analyze the given statements below. Write the chosen letter on a separate sheet of paper.

- Which biomolecular group carries and passes on the hereditary information of the organism?
 - carbohydrates
 - lipids
 - nucleic acids
 - proteins
- Which biomolecules are significant features of the cell membrane?
 - carbohydrate and nucleic acid
 - lipid and nucleic acid
 - nucleic acid and protein
 - protein and lipid
- Atom is the basic unit of a chemical element. What are the atoms that make up carbohydrates?
 - C and H
 - C, H and N
 - C, H and O
 - C, H, O and N

4. Which organic molecule gives fast source of energy?
 - a. carbohydrates
 - b. lipids
 - c. nucleic acids
 - d. proteins
5. Which nutrient group is used in the composition of waxes and responsible for insulation of some organisms?
 - a. carbohydrates
 - b. lipids
 - c. nucleic acids
 - d. proteins
6. Which of the following does NOT belong to the classification of lipids?
 - a. hemoglobin
 - b. phospholipids
 - c. steroid
 - d. triglyceride
7. Which of the following is considered as the building blocks of protein?
 - a. amino acids
 - b. nucleic acids
 - c. nucleotides
 - d. polypeptides
8. The excessive consumption of carbohydrates is converted into which polysaccharide that is stored in the liver and in muscles?
 - a. creatinine
 - b. glycogen
 - c. hemoglobin
 - d. uric acid
9. Which of the following is a monosaccharide which is used in dextrose?
 - a. fructose
 - b. galactose
 - c. glucose
 - d. lactose
10. Which is a good example of saturated fat?
 - a. butter
 - b. corn oil

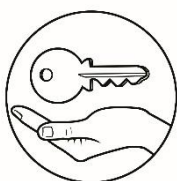
- c. olive oil
 - d. sunflower oil
11. Which is termed as the blueprint of life?
- a. deoxyribonucleic acid
 - b. fatty acid
 - c. nucleic acid
 - d. ribonucleic acid
12. Proteins are composed of four elements, namely: carbon, hydrogen, oxygen and what other element?
- a. magnesium
 - b. nitrogen
 - c. phosphorous
 - d. sulfur
13. This is a major insoluble fibrous protein found in connective tissues such as tendons, ligaments, skin, cartilage and the cornea of the eye. What is it?
- a. albumin
 - b. collagen
 - c. keratin
 - d. pepsin
14. Which polypeptide stores oxygen in muscles?
- a. enzyme
 - b. heme
 - c. lipase
 - d. myoglobin
15. Which is not a part of a nucleotide?
- a. nitrogenous base
 - b. phosphate group
 - c. ribonucleic acid
 - d. sugar



Additional Activities

Activity 1.5 Biomolecule Poem

Summarize the topics and creatively translate them into a poem describing what you have learned about biomolecules. Write your answer on a separate answer sheet.



Answer Key

<p>What I Know</p> <ol style="list-style-type: none"> 1. True 2. True 3. insoluble 4. Nucleic acid 5. True 6. True 7. True 8. Glucose 9. not easily 10. amino acids 11. True 12. True 13. True 14. lipid 15. saturated 	<p>What's More</p> <ol style="list-style-type: none"> 1. carbon, hydrogen and oxygen 2. carbon, hydrogen and oxygen 3. carbon, hydrogen, oxygen and nitrogen 4. carbon, hydrogen, oxygen, nitrogen and phosphorus 	<p>Additional Activities</p> <p>Answers may vary</p>
<p>What's In</p> <p>A. In any order of chosen nutrients as long as cholesterol and fats are last in the list.</p> <p>B. In any order of chosen nutrients as long as sodium is last in the list.</p> <p>C. In any order of chosen nutrients as long as carbohydrate is last in the list.</p>	<p>What I Have Learned</p> <p>See table below.</p>	<p>Assessment</p> <ol style="list-style-type: none"> 1. C 2. D 3. C 4. A 5. B 6. A 7. A 8. B 9. C 10. A 11. A 12. B 13. B 14. D 15. C
<p>What's New</p> <p>Answers may vary</p>	<p>What I Can Do</p> <p>See table below.</p>	

What I Have Learned					
Description	Carbohydrates	Proteins	Lipids	Nucleic Acids	
Elements	C, H, O	C, H, O, N Sometimes S and also other metals.	C, H, O Can be with P for Phospholipids	C, H, O, N, P	
Monomer	Saccharides	Amino acids	Fatty acids (technically, there is not one uniform sub-unit for lipids)	Nucleotides	
Used/Function	Primary source of energy in the body; Structural material in plants	Structural material; Enzyme; Storage molecule; Transport molecule; Antibody	Source of energy; Maintaining body heat; Aid in digestion; Material for cell membrane; Signal molecules	Protein synthesis; Code of life	
Examples	Bread, rice, fruits, grains, root crops, sugar	Meat, dairy products, nuts, egg	Oil, butter, nuts, fish	---	

What I Can Do

Disorders/ Diseases	Related Macromolecules	Function of Macromolecules
Diabetes Mellitus	Carbohydrate	Carbohydrate becomes sugar when break down which gives energy. Increased carbohydrate intake causes elevated blood sugar.
Kwashiorkor	Protein	Protein is essential in building muscle mass. Decreased intake of protein can lead to Kwashiorkor.
Myocardial Infarction	Lipid	Lipids or Fats maintain body temperature. Too much lipids or fats in the body narrow blood vessels which decreases blood flow.

References

Commission on Higher Education. *Teaching Guide for Senior High School: Physical Science*. Book.

<https://drive.google.com/file/d/0B869YF0KEHr7SHFGVG5mVFFhcXc/view>.

Creative Commons Attribution-NonCommercial-ShareAlike 4.0

Wikipedia.2020. "Carbohydrate loading." Last modified April 19, 2020.

<https://en.wikipedia.org/wiki/carbohydrateloading>

For inquiries or feedback, please write or call:

Department of Education - Bureau of Learning Resources (DepEd-BLR)

Ground Floor, Bonifacio Bldg., DepEd Complex
Meralco Avenue, Pasig City, Philippines 1600

Telefax: (632) 8634-1072; 8634-1054; 8631-4985

Email Address: blr.lrqad@deped.gov.ph * blr.lrpd@deped.gov.ph